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The effects of beaver inhabitation on wetland vegetation dynamics on Mount Desert Island, Maine.

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Mount Desert Island (MDI), is home to Acadia National Park (ANP). The fresh wetlands of MDI range in type from cattail marshes and sedge meadows to Sphagnum fens and white-cedar swamps. The diversity of wetland plant communities across the landscape is a result of beaver activity in combination with internal vegetation dynamics, but the relationships are poorly understood. Specific management strategies may be necessary to preserve wetland diversity at the landscape level. We surveyed 26 MDI wetlands along a beaver inhabitation gradient during 2000-2004, characterizing vegetation communities, hydrology, water chemistry, and microtopography in order to understand how wetland plant communities respond to beaver disturbance.

Our research indicates that beaver wetlands can be characterized by successional and stability gradients. They tend to fall into two groups – transitional wetlands and "stable" wetlands, (MRPP test $R=0.087$, $p<0.001$). The transitional wetlands range from emergent marsh/sedge meadow to wooded swamp, while the "stable" group consists of sites with floating Sphagnum mats and dwarf shrub plant communities. Transitional wetlands tend to follow hydroseral trajectories. They become marshes and sedge meadows during and immediately following beaver inhabitation. After 5-10 years of abandonment, a Sphagnum fen forms. Sphagnum begins to accumulate, leading to vegetation characterized by Acer rubrum seedlings, Thelypteris palustris, and Iris versicolor in addition to sedge meadow and wooded-swamp species. Finally, Larix laricina, Thuja occidentalis, and Picea mariana invade, and the site becomes a wooded swamp. In contrast, the vegetation in the Sphagnum/shrub sites has the potential to remain stable despite hydrologic alteration due to beaver activity. It is dominated by Chamaedaphne calyculata and Myrica gale, which both have indicator values >95.0 ($p=0.001$). The stable sites also tend to be larger in size with more peat accumulation, but less microtopographic richness than the transitional sites. The differences between transitional and stable wetlands may indicate a change in the factors influencing vegetation. Transitional sites are heavily influenced by beaver activity, while more stable sites are driven by positive feedbacks associated with shrub and Sphagnum dominance.

Dwarf shrub and floating-mat wetlands may remain relatively stable no matter what beaver management strategies are employed, while the vegetation composition of transitional wetlands is likely to change in response to beaver management. High beaver populations tend to force new beaver colonies into less favorable sites. Beaver quickly abandon these sites and do not return when populations decrease. This pattern creates transitional Sphagnum fens. In contrast, when beaver populations are low, activity often focuses on a few high-quality colony sites that are occupied almost continuously. This pattern of beaver occupation creates transitional sedge meadow and marsh plant communities adapted to frequently-fluctuating water levels. Occasional management for high beaver populations is necessary to initiate successional change and preserve the diversity of transitional wetlands, but perpetually high beaver populations may result in a high number of permanently-inhabited marshes and sedge meadows with few Sphagnum fens. Shrub and floating-mat wetland plant communities may serve as refugia for organisms dependent on specific transitional habitats.